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PALOUSE RIVER TRANSECT STUDY. STATION NUMBER 153010, JULY 8 AND 9, 1969

Gary L. Burns

Federal Water Pollution Control Administration
Portland, Oregon

February 1970

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PALOUSE RIVER TRANSECT STUDY

Station No. 153010

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Prepared by
Gary L. Burns

Working Paper
No. 73

Technical Assistance and Investigations Branch
Office of Technical Programs
Federal Water Pollution Control Administration
Northwest Region
Portland, Oregon

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INTRODUCTION

Purpose

The Pollution Surveillance Branch, Office of Technical Programs, Federal Water Pollution Control Administration, Northwest Region, has an established network of stations from which long-term water quality monitoring samples are collected, analyzed, and the data reported on a routine basis. Knowledge of conditions peculiar to any station is helpful in the evaluation of the data obtained. The purpose of this study is to document seasonal, diurnal, and spatial variances in water quality at Station No. 153010 located at River Mile 126.5 on the Palouse River between the towns of Potlatch, Idaho and Palouse, Washington (Figure 1).

A similar study was performed on January 21 and 22, 1969. The report on that study is available in the files of the Pollution Surveillance Branch.

Objectives

The objectives of the survey were to answer the following questions:

1. What is the optimum sampling point in the stream cross-section under low flow conditions?

2. What are the diurnal changes in physical, chemical, biochemical, and bacteriological water quality at the sampling site?

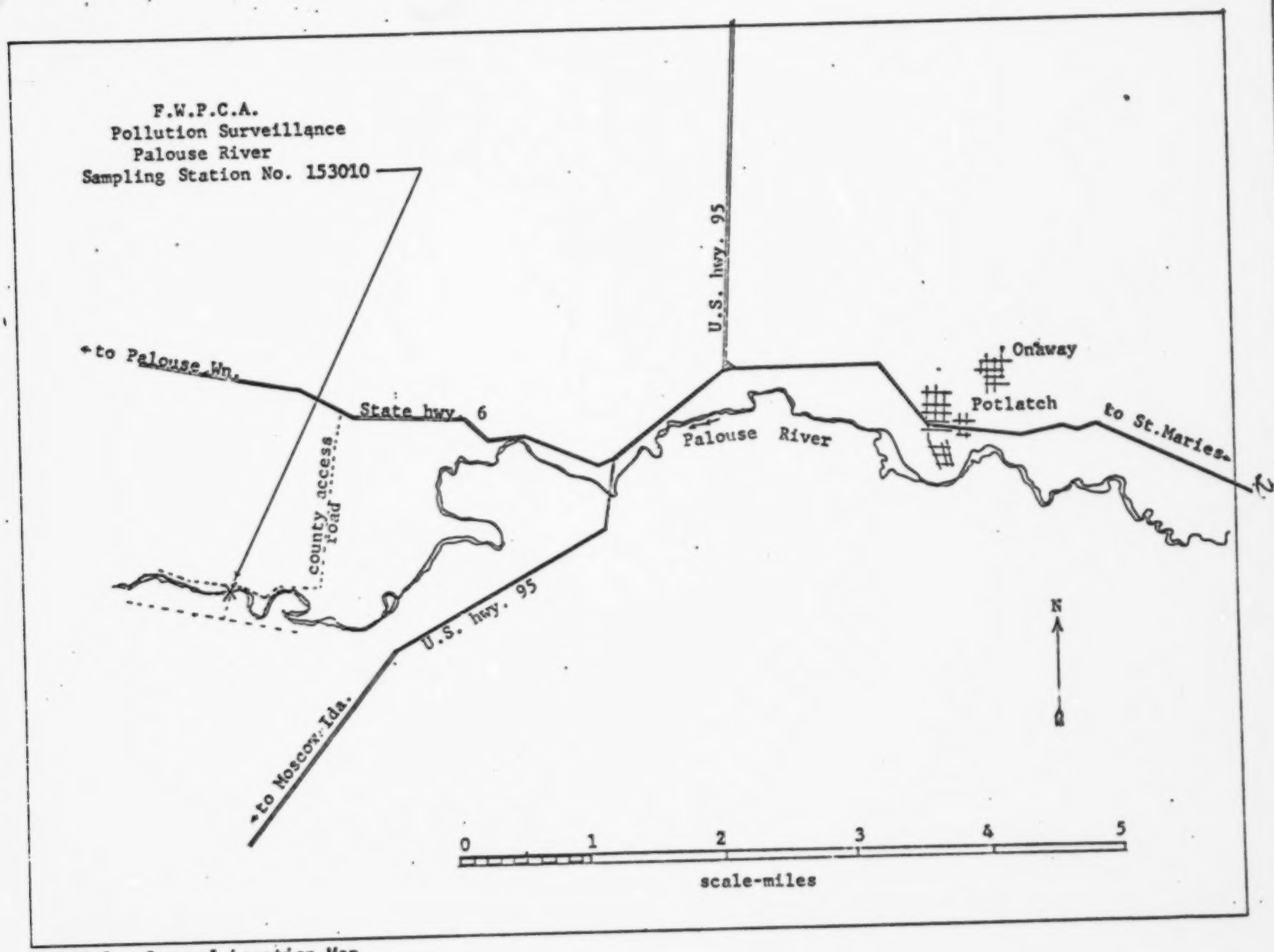


FIGURE 1. General Location Map

3. What general factors influence water quality at the sampling site?

Authority

Authorization for this study was from the Federal Water Pollution Control Act, as amended. The study was performed by the Technical Assistance and Investigations Branch, at the request of the Pollution Surveillance Branch, Office of Technical Programs.

Sampling Program

1. Water samples were collected every two hours for a 24-hour period. The initial sample collection was at noon (1200 hours) on July 8, 1969, with the final samples taken at noon (1200 hours) on July 9, 1969.

2. Three sampling points were chosen in the stream cross-section, one located in the center and the other two at quarter points in the stream. Because of the low flow conditions, a single subsurface sample was taken at each station.

3. The following analyses were performed on the samples: temperature, pH, conductivity, dissolved oxygen, total coliform, and fecal coliform.

SUMMARY

Findings

1. The main streamflow was concentrated at the south one-third section of the stream (Figure 5).

2. The parameter values for all cross-section samples exhibited close proximity to each other (Table 1).

3. The average[1/] pH ranged from a low of 7.1, from 0200 through 0600 hours, to a high of 7.4, from 1400 through 2200 hours (Figure 2).

4. Temperatures reached an average maximum value of 24.8°C at 1600 hours; then declined until the average low value at 19.0°C was recorded at 0600 hours; then temperatures rose to 23.3°C at 1200 hours on July 9, 1969 (Figure 3).

5. Conductivity ranged from 47 micromho per centimeter (μmho/cm) to 69 μmho/cm (Figure 2). The maximum conductivity of 69 μmho/cm was recorded at 1200 hours on July 9, 1969 and the minimum of 46 μmhl/cm was recorded at 0600 hours on July 8, 1969. The pattern was similar to the other parameters, with the average highs occurring in the morning through mid-morning, then dropping to the lower values during the night.

6. Dissolved oxygen (DO) content and percent saturation showed a parallel fluctuation, with the maximum DO of 8.7 milligrams per liter (mg/l) and the high of 112 percent saturation occurring at 1800 hours (Figure 3). The values then dropped to lows at 0600 hours of 6.4 mg/l and 75 percent, respectively.

[1/] All parameter values quoted in the Findings are hourly averages for the three cross-section samples.

TABLE 1

PALOUSE RIVER STREAM SURVEY DATA
7(8-9)69

TIME	TEMPERATURE ° C			PH			CONDUCTIVITY			DISSOLVED OXYGEN			D.O. % SATURATION		
STA.	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
1200	21.8	22.0	22.0	7.3	7.4	7.3	60	51	-	8.26	8.30	8.30	101	103	103
1400	23.4	23.2	23.2	7.4	7.5	7.4	63	59	70	8.60	8.12	8.18	104	103	103
1600	24.7	24.8	25.0	7.4	7.5	7.3	57	65	55	8.90	8.28	8.70	105	107	118
1800	24.4	24.2	2.44	7.3	7.4	7.3	60	59	60	8.92	8.90	8.28	115	115	107
2000	23.0	23.2	23.5	7.5	7.3	7.3	57	57	62	8.32	8.30	8.36	105	105	106
2200	22.0	21.8	21.6	7.4	7.4	7.3	57	59	57	7.80	7.40	7.22	97	93	89
2400	21.0	21.0	21.0	7.2	7.3	7.2	55	57	58	7.82	7.12	7.38	95	88	89
0200	21.2	21.1	21.2	7.1	7.2	7.1	49	49	51	6.18	6.86	6.68	76	84	81
0400	20.4	20.6	20.2	7.1	7.1	7.1	51	53	52	6.48	6.52	6.60	78	79	79
0600	19.0	19.0	19.0	7.0	7.1	7.1	46	47	47	6.48	6.40	6.40	76	75	75
0800	21.0	21.0	21.2	7.1	7.2	7.1	52	51	52	6.50	6.52	6.40	79	79	78
1000	22.0	21.8	21.8	7.1	7.2	7.2	63	56	55	7.00	7.10	7.12	87	87	87
1200	23.5	23.5	23.5	7.3	7.3	7.3	70	68	68	7.42	7.50	8.60	95	96	104

7. As shown in Figure 4, the fecal coliform densities displayed an unstable pattern, with the low value of 12 fecal coliforms per 100 milliliters (FC/100 ml) occurring on the first sampling run at 1200 hours. The general pattern after 1200 hours was an increase to a high of 59 FC/100 ml at 1000 hours the following morning.

8. The maximum total coliform count of 1383 total coliforms per 100 milliliters (TC/100 ml) was recorded at noon on July 8, 1969 and the minimum total coliform count of 257 TC/100 ml was recorded at 0600 hours on July 9, 1969.

9. The rate of streamflow during the study period was 15 to 18 cubic feet per second (cfs), with a velocity of 0.5 feet per second (fps).

Conclusions

1. The entire stream cross-section appeared homogeneous as to water quality parameter measurements.

2. Physical characteristics dictate sampling at the south one-third point on the bridge to yield the optimum sampling conditions.

3. With the exception of the radical fluctuation pattern of fecal coliform concentrations, the maximum parameter values occurred between the hours of 10:00 am and 8:00 pm. The minimum values were recorded from 12:00 midnight to 6:00 am.

4. The upstream contributors that would tend to influence

water quality are: (1) the Potlatch Forest Industries' sawmill located adjacent to the community of Potlatch; (2) domestic lagoon discharges from Potlatch municipal system and a few upstream communities; (3) individual untreated domestic waste discharges from residences located close to the stream; and (4) animal wastes from livestock occupying stream-bank lands.

Recommendations

1. The bridge sampling point should be located at the south one-third point.

2. For the sake of consistency, the routine samples should be collected in the time period from mid-morning to mid-afternoon.

3. An additional study should be conducted during low flow conditions, concentrating on possible sources of pollution upstream from the sampling station.

STUDY AREA

General Description

The Palouse River has a drainage area of 132 square miles and is located in "wheat country" with rolling hills rising 20 to 80 feet above the valleys. Wheat is the main crop, with other crops produced in smaller volumes. Many of the farms have cattle and other livestock. The only industry of any size is a sawmill located on the Palouse River adjacent to the town of Potlatch (population 880).

Station Location and Description

The Palouse River Pollution Surveillance Sampling Station No. 153010 is located roughly 48 miles north of Lewiston, Idaho and about 4 miles east of the Washington-Idaho State line. The station lies between the towns of Potlatch, Idaho and Palouse, Washington, and is specifically positioned as follows:

> Latitude 46°54'23" N., Longitude 117°00'22" W. at River Mile 126.50. The station is located 8.05 river miles downstream from the town of Potlatch (Figure 1).

SAMPLING AND ANALYTICAL METHODS

Sampling Methods and Schedule

Chemical and bacteriological analyses were performed in a 17-foot enclosed trailer modified for use as a field laboratory. The trailer was located near the sampling station during the survey.

Water samples were collected every two hours during the 24-hour period. Three points in the cross-section (Figure 5) were sampled, using a Kemmerrer[2/] sampler. A single "haul" provided enough water to fill containers for chemical (dissolved oxygen, conductivity, and pH) and bacteriological analyses.

Temperatures were noted and recorded at the time of sampling using a hand thermometer.

The dissolved oxygen samples were chemically "fixed" at the time of collection for titration upon return to the trailer lab.

Analytical Procedures

The following analytical methods were used:

pH was determined with a Beckman zeromatic model pH meter.

Conductivity was determined using an Industrial Instruments Model RC-16 B2 conductivity bridge.

2/ The use of brand names is for identification only, and constitutes no endorsement by the United States Department of the Interior or by the Federal Water Pollution Control Administration.

Dissolved oxygen samples were titrated, using an Aesterberg (Azide) modification of the Winkler method as found in Standard Methods.(1)

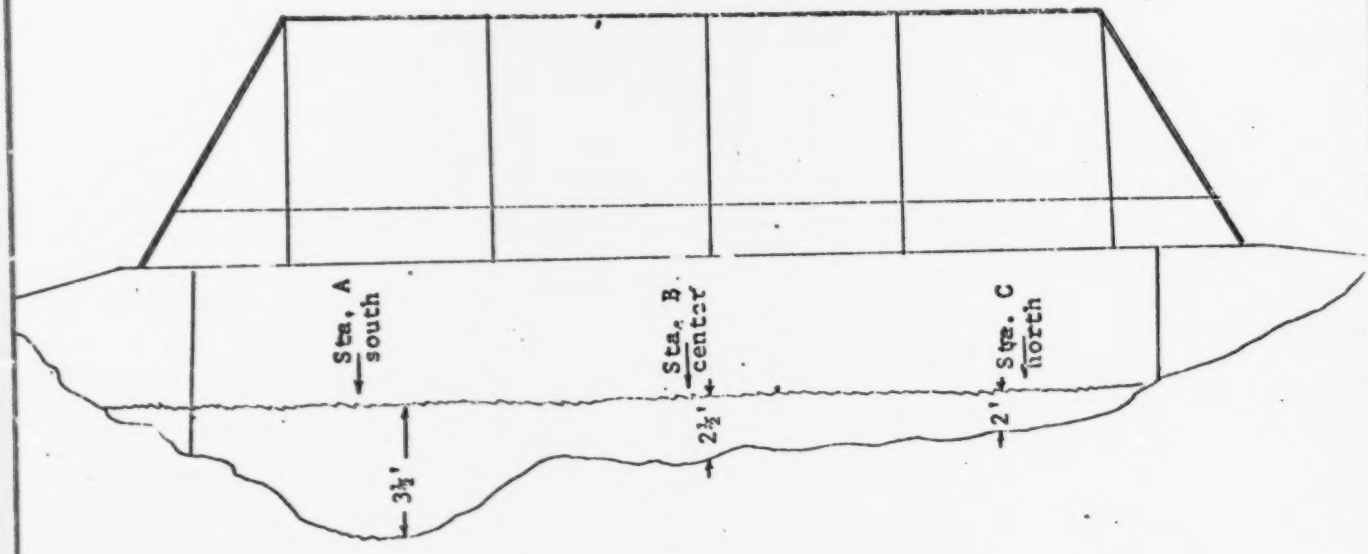
The membrane filter method for fecal coliform determinations was conducted in accordance with the procedures as described by Geldreich et al.(2) Studies by Geldreich(3) have confirmed the reliability of this method as compared to the most probable number (MPN) fecal coliform test found in Standard Methods.(1)

The bacteriological samples were incubated and counted in the field.

RESULTS

Flow Measurements

The average depth of the cross-section was 2 feet, with a maximum depth of 3½ feet in the south (channel) portion of the stream.



The flow rate was calculated by surface floats at 15 to 18 cfs, with a velocity of 0.5 fps.

At this extreme low flow, a low water protrusion in the bank was present about 15 feet upstream from the bridge on the north side, producing an eddy current at the north sampling point. The main channel was located through the south one-third section of the stream (Figure 5).

DISCUSSION

Data tabulation (Table 1) shows little discrepancy among parameter values at the three cross-section sampling points. It may be assumed the stream is "thoroughly mixed" at this point. The eddy current (Figure 5) evidently has no effect upon the cross-section consistency.

As noted in Figures 3 and 4, the temperature and total coliform values exceeded the maximum limits of the Federal-State standards during the study. The temperature values remained above the standard limits for all but one sampling run (0600 hours on 8/9/69) during the 24-hour period (Figure 3). The total coliform concentration levels were in excess of the Federal-State standards during the entire 24-hour study period (Figure 4).

The Potlatch Forest Industries' logpond at the Potlatch sawmill is an "in and out" system which receives water from the Palouse River and discharges back into the Palouse at the lower end. This system shown little preference as to "slug" discharges except perhaps during washing or loading operations.

The municipal domestic system at Potlatch discharges into the Palouse River as holding pond "seepage". This operation also has no control as to discharge periods, although peak load periods could increase the discharge process.

With the low flow encountered, any contaminants would have a much greater influence on water quality due to the lack of dillution.

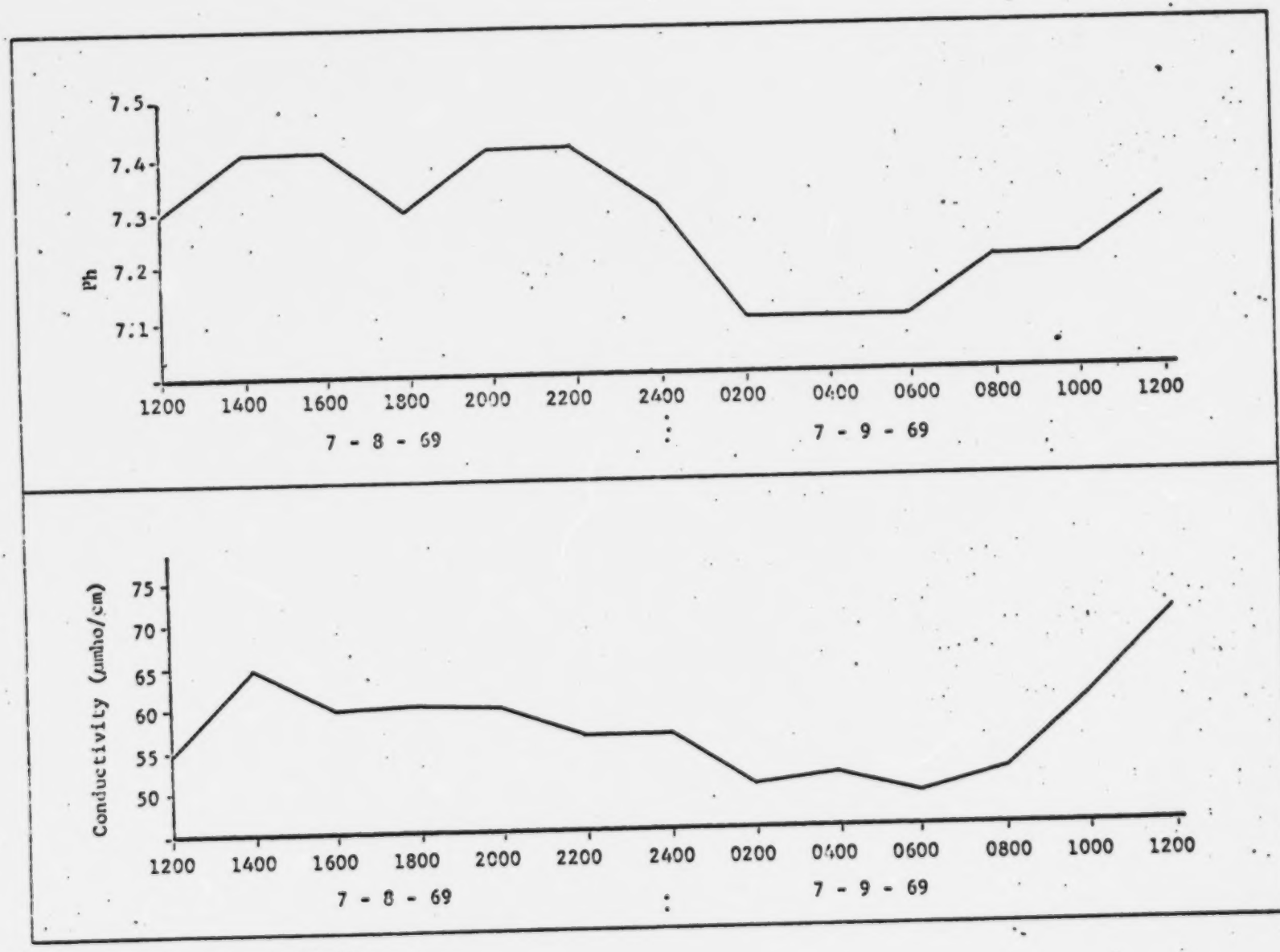


FIGURE 2 pH and Conductivity

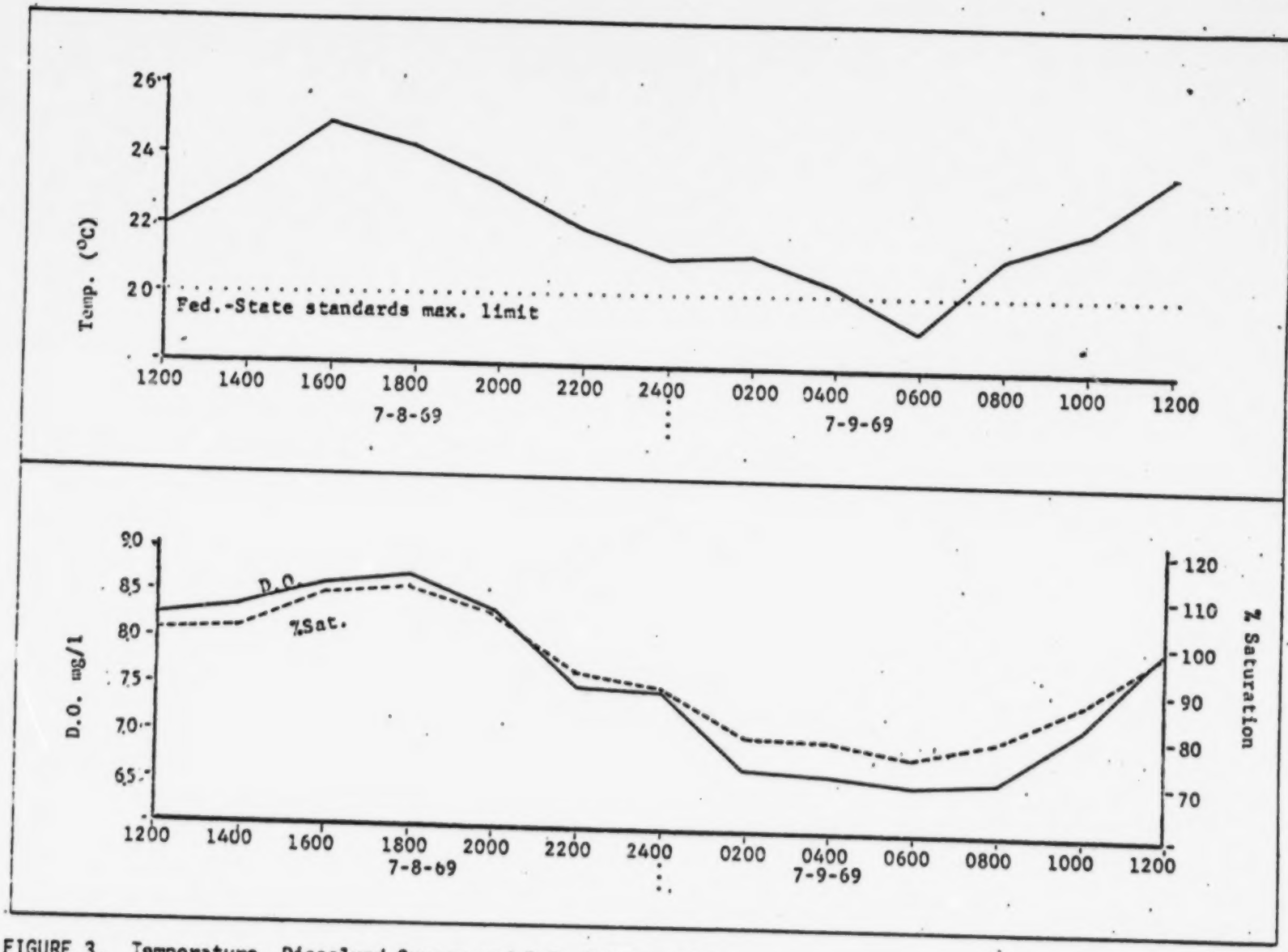


FIGURE 3. Temperature, Dissolved Oxygen and D.O. % Saturation.

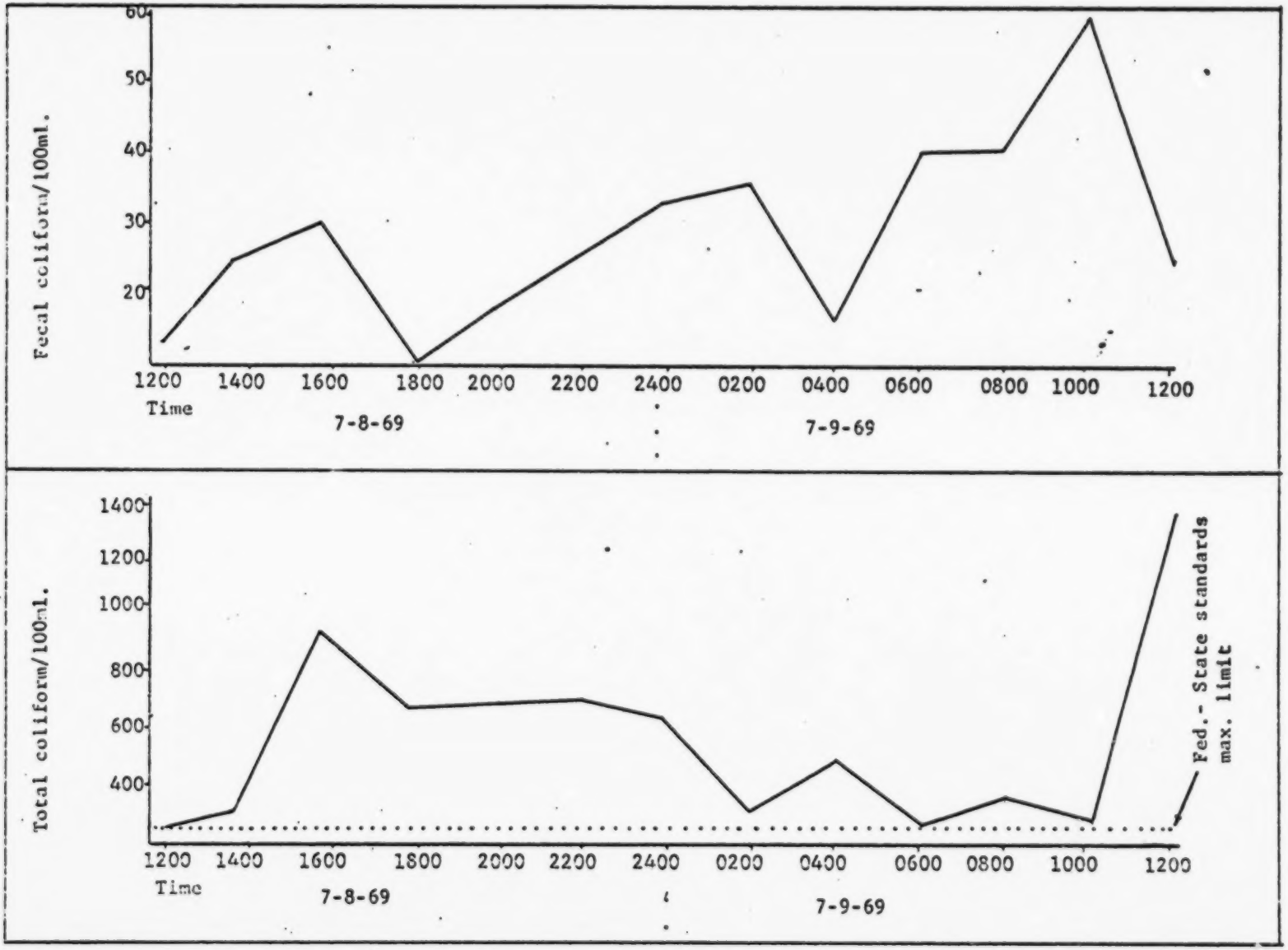


FIGURE 4. Total and Fecal coliform.

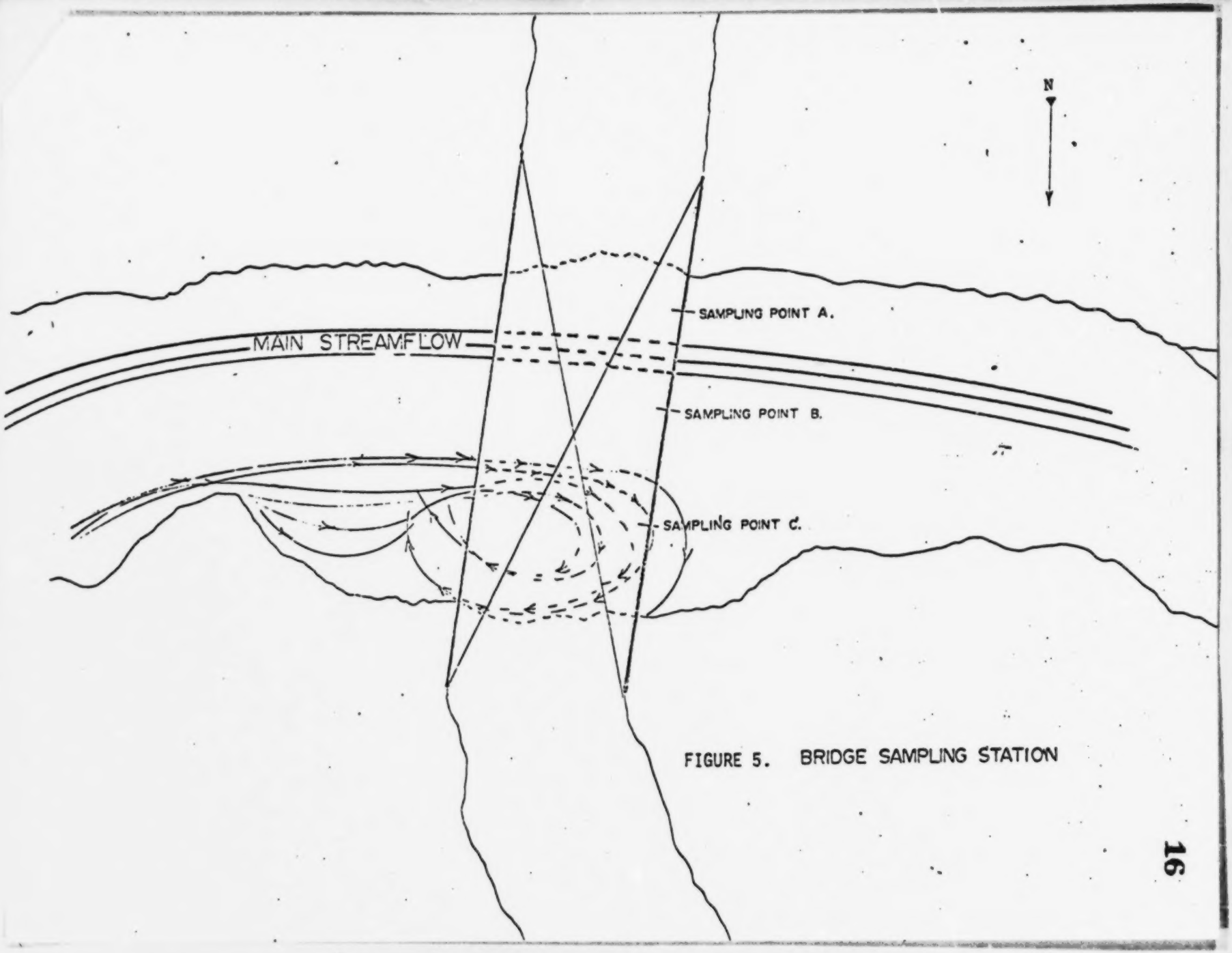


FIGURE 5. BRIDGE SAMPLING STATION

The radical 24-hour pattern of fecal coliform concentration (Figure 4) could be attributed to the untreated rural discharges from residences located adjacent to the stream above the sampling station. There also may be some influence by livestock waste (a number of cattle were present along the river at and above the sampling site). A concentrated sanitary survey in the area would be needed to substantiate these suppositions.

The conductivity (Figure 2) displayed a somewhat stable pattern during the 24-hour period. The values indicate a relative low concentration of dissolved solid material.

The parallel fluctuation patterns of the dissolved oxygen, percent saturation of dissolved oxygen and pH (Figures 2 and 3) confirm the presence of photosynthetic organisms. These organisms produce oxygen during the day, causing an increase in dissolved oxygen and the percent dissolved oxygen concentration levels. During the dark hours, these organisms produce CO_2 through respiration and also consume oxygen, the result being a decrease in dissolved oxygen, percent saturation, and pH value.

REFERENCES

(1) American Public Health Association, Inc. Standard methods for the examination of water and wastewater, 12th ed. 1962.

(2) Geldreich, Edwin E., et al. Fecal-coliform-organism medium for membrane filter technique. Jour. Amer. Water Works Assoc. 57:2, 208-214. 1965.

(3) Geldreich, Edwin E., Sanitary significance of fecal coliforms in the environment. Water Pollution Control Research Series Publication No. WP-20-3. U.S. Dept. of Interior, Federal Water Pollution Control Administration. 1966.

(4) Idaho State Board of Health. Rules and regulations for standards of water quality for the interstate waters of Idaho and disposal therein of sewage and industrial wastes. June 1967.

APPENDIX

STREAM SURVEY DATA

STREAM SURVEY DATA

STREAM Palouse
STATION NO. 153010
DATE 7-8-69
TIME 1200

Parameter	Location in cross section						AVE.
	A	B	C	D			
Temperature °C	21.8	22.0	22.0				21.9
PH	7.3	7.4	7.3				7.3
Conductivity µmho	60	51	-				55
Dissolved Oxygen mg/l	8.26	8.30	8.30				8.29
D.O. % Saturation	101	103	103				102

STREAM SURVEY DATA

STREAM Palouse
STATION NO. 153010
DATE 7-8-69
TIME 1400

Parameter	Location in cross section						AVE.
	A	B	C	D			
Temperature °C	23.4	23.2	23.2				23.3
PH	7.4	7.5	7.4				7.4
Conductivity µmho.	63	59	70				64
Dissolved Oxygen mg/l	8.60	8.12	8.18				8.40
D.O. % Saturation	104	103	103				103

STREAM SURVEY DATA

STREAM Palouse
STATION NO. 153010
DATE 7-8-69
TIME

Parameter	Location in cross section						AVE.
	A	B	C	D			
Temperature °C	24.7	24.8	25.0				24.8
PH	7.4	7.5	7.3				7.4
Conductivity μmho	57	65	55				59
Dissolved Oxygen mg/l	8.90	8.28	8.70				8.60
D.O. % Saturation	105	107	118				110

STREAM SURVEY DATA

STREAM Palouse
STATION NO. 153010
DATE 7-8-69
TIME 1800

Parameter	Location in cross section A	B	C	D			AVE.
Temperature °C	24.4	24.2	24.4				24.3
PH	7.3	7.4	7.3				7.3
Conductivity µmho	60	59	60				60
Dissolved Oxygen mg/l	8.92	8.90	8.28				8.70
D.O. % Saturation	115	115	107				112

STREAM SURVEY DATA

STREAM Palouse

STATION NO. 153010

DATE 7-8-69

TIME 2000

Parameter	Location in cross section						AVE.
	A	B	C	D			
Temperature °C	32.0	32.2	32.5				32.2
PH	7.5	7.3	7.3				7.4
Conductivity μmho	57	57	62				59
Dissolved Oxygen mg/l	8.32	8.30	8.36				8.33
D.O. % Saturation	105	105	106				105

STREAM SURVEY DATA

STREAM Palouse
STATION NO. 153010
DATE 7-8-69
TIME 2200

Parameter	Location in cross section						
	A	B	C	D			AVE.
Temperature °C	22.0	21.8	21.6				21.8
PH	7.4	7.4	7.3				7.4
Conductivity μmho.	57	59	57				57
Dissolved Oxygen mg/l	7.80	7.40	7.22				7.47
D.O. % Saturation	97	93	89				93

STREAM SURVEY DATA

STREAM Palouse
STATION NO. 153010
DATE 7-8-69
TIME 2400

Parameter	Location in cross section A	B	C	D			AVE.
Temperature °C	21.0	21.0	21.0				21.0
PH	7.2	7.3	7.2				7.3
Conductivity µmho.	55	57	58				57
Dissolved Oxygen mg/l	7.82	7.12	7.38				7.44
D.O. % Saturation	95	88	89				91

STREAM SURVEY DATA

STREAM Palouse
STATION NO. 153010
DATE 7-9-69
TIME 0200

Parameter	Location in cross section A	B	C	D			AVE.
Temperature °C	21.2	21.1	21.2				21.1
PH	7.1	7.2	7.1				7.1
Conductivity µmho.	49	49	51				50
Dissolved Oxygen mg/l	6.18	6.86	6.68				6.64
D.O. % Saturation	76	84	81				80

STREAM SURVEY DATA

STREAM Palouse
STATION NO. 153010
DATE 7-9-69
TIME 0400

Parameter	Location in cross section						AVE.
	A	B	C	D			
Temperature °C	20.4	20.6	20.2				20.4
PH	7.1	7.1	7.1				7.1
Conductivity µmho	51	53	52				52
Dissolved Oxygen mg/l	6.48	6.52	6.60				6.53
D.O. % Saturation	78	79	79				79

STREAM SURVEY DATA

STREAM Palouse
STATION NO 153010
DATE 7-9-69
TIME 0800

Parameter	Location in cross section						AVE.
	A	B	C	D			
Temperature °C	21.0	21.0	21.2				21.1
PH	7.1	7.2	7.2				7.2
Conductivity µmho.	52	51	52				52
Dissolved Oxygen mg/l	6.50	6.52	6.40				6.47
D.O. % Saturation	79	79	78				79

STREAM SURVEY DATA

STREAM Palouse
STATION NO. 153010
DATE 7-9-69
TIME 1000

Parameter	Location in cross section A	B	C	D			AVE.
Temperature °C	22.0	21.8	21.8				21.9
PH	7.1	7.2	7.2				7.2
Conductivity µr.mo.	63	56	55				58
Dissolved Oxygen mg/	7.00	7.10	7.12				7.07
D.O. % Saturation	87	87	87				87

STREAM SURVEY DATA

STREAM Palouse
STATION NO. 152010
DATE 7-9-69
TIME 1200

Parameter	Location in cross section						
	A	B	C	D			AVE.
Temperature °C	23.5	23.5	23.5				23.5
PH	7.3	7.3	7.3				7.3
Conductivity µmho	70	68	68				69
Dissolved Oxygen mg/l	7.42	7.50	8.60				7.84
D.O. % Saturation	95	96	104				98

STREAM SURVEY DATA

PAGE 1 OF 1

Total COLIFORMS

STATION NO 153010

TIME	LOCATION IN CROSS SECTION												AVERAGE NUMBERS /100 ml.
	Sample point A.				Sample point B.				Sample point C.				
	ml.	ml.	10 ml.	number /100 ml.	ml.	ml.	10 ml.	number /100 ml.	ml.	ml.	10 ml.	number /100 ml.	
1200	-	-	67	670	-	-	92	920	-	-	36	360	650
1400	-	-	60	600	-	-	26	260	-	-	04	40	300
1600	-	-	147	1470	-	-	45	450	-	-	86	860	927
1800	-	-	134	1340	-	-	45	450	-	-	19	190	660
2000	-	-	51	510	-	-	74	740	-	-	77	770	673
2200	-	-	51	510	-	-	74	740	-	-	77	770	673
2400	-	-	49	490	-	-	33	330	-	-	87	870	630
0200	-	-	19	190	-	-	44	440	-	-	29	290	307
0400	-	-	54	540	-	-	57	570	-	-	32	320	473
0600	-	-	28	280	-	-	26	260	-	-	23	230	257
0800	-	-	21	210	-	-	05	50	-	-	09	90	350
1000	-	-	24	240	-	-	21	210	-	-	26	260	270
1200	-	-	172	1720	-	-	117	1170	-	-	126	1260	1383

STREAM SURVEY DATA

PAGE 1 OF

Fecal COLIFORMS

STATION NO. 153010

TIME	LOCATION IN CROSS SECTION												AVERAGE NUMBER /100 ml.
	Sample point A.				Sample point B.				Sample point C.				
	ml	vol/50	vol/10	number /100 ml.	ml	vol/50	vol/10	number /100 ml.	ml.	vol/50	vol/10	number /100 ml.	
1200	-	04	-	08	-	09	-	18	-	05	-	10	12
1400	-	16	-	32	-	11	-	22	-	11	-	22	25
1600	-	13	-	26	-	11	-	22	-	08	-	16	30
1800	-	05	-	10	-	04	-	08	-	06	-	12	10
2000	-	11	-	22	-	05	-	10	-	09	-	18	17
2200	-	12	-	24	-	11	-	22	-	14	-	28	25
2400	-	12	-	24	-	11	-	22	-	11	-	22	33
0200	-	11	-	22	-	19	-	38	-	24	-	48	36
0400	-	13	-	26	-	18	-	36	-	07	-	14	16
0600	-	24	-	48	-	17	-	34	-	12	-	24	40
0800	-	31	-	62	-	11	-	22	-	19	-	38	40
1000	-	22	-	44	-	32	-	64	-	35	-	70	59
1200	-	10	-	20	-	18	-	36	-	06	-	12	23